

**Doc. Number:**

- ☐ Tentative Specification
☐ Preliminary Specification
☒ Approval Specification

MODEL NO.: N156B6
SUFFIX: L0B

Customer: Lenovo International

APPROVED BY

SIGNATURE

Note

Please return 1 copy for your confirmation with your signature and comments.

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REVISION HISTORY

Version	Date	Page	Description
1.0	Aug.20, 2010	All	Spec Ver.1.0 was first issued.
3.5	Nov.01, 2010	All	Spec Ver.3.5 was updated for 40pcs LED structure and new spec format.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

N156B6-L0B is a 15.6" (15.547" diagonal) TFT Liquid Crystal Display module with LED Backlight unit and 40 pins LVDS interface. This module supports 1366 x 768 HD mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction.

1.2 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Screen Size	15.547 diagonal		
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1366 x R.G.B. x 768	pixel	-
Pixel Pitch	0.252 (H) x 0.252 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Hard coating (3H), Glare	-	-
Luminance, White	220	Cd/m2	
Power Consumption	Total 5.184 W (Max.) @ cell 0.9 W (Max.), BL 4.284W (Max.)		(1)

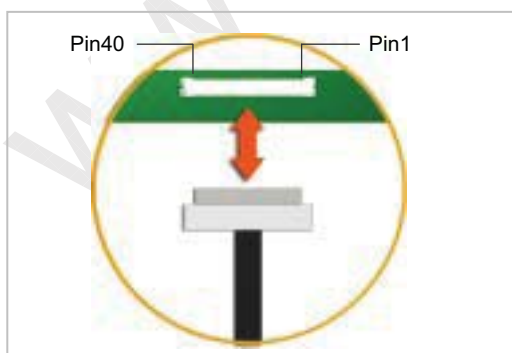
Note (1) The specified power consumption (with converter efficiency) is under the conditions at VCCS = 3.3 V, $f_v = 60$ Hz, LED_VCCS = Typ, fPWM = 200 Hz, Duty=100% and $T_a = 25 \pm 2$ °C, whereas mosaic pattern is displayed.

2. MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	358.8	359.3	359.8	mm	(1)
	Vertical (V)	209	209.5	210	mm	
	Thickness (T)	-	5.2	5.5	mm	
Bezel Area	Horizontal	349.28	349.58	349.88	mm	
	Vertical	197.99	198.29	198.59	mm	
Active Area	Horizontal	-	344.232	-	mm	
	Vertical	-	193.536	-	mm	
Weight		-	430	445	g	

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

2.1 CONNECTOR TYPE



Please refer Appendix Outline Drawing for detail design.

Connector Part No.: IPEX-20455-040E-12 or Tyco 5-2069716-3

User's connector Part No: IPEX-20453-040T-01

3. ABSOLUTE MAXIMUM RATINGS

3.1 ABSOLUTE RATINGS OF ENVIRONMENT

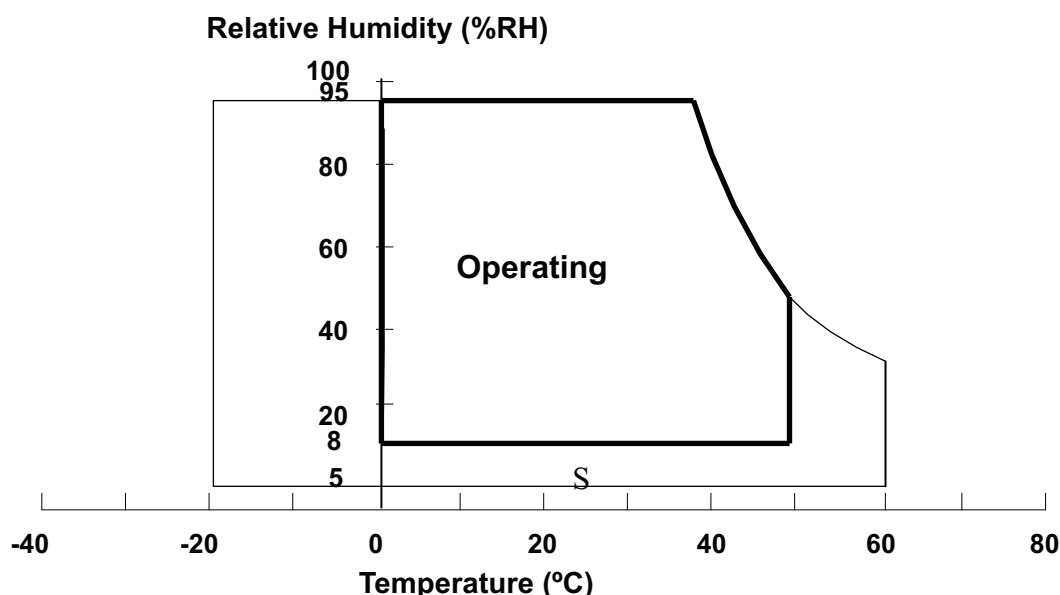
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-20	+60	°C	(1)
Operating Ambient Temperature	T _{OP}	0	+50	°C	(1), (2)

Note (1) (a) 90 %RH Max. (Ta ≤ 40 °C).

(b) Wet-bulb temperature should be 39 °C Max. (Ta > 40 °C).

(c) No condensation.

Note (2) The temperature of panel surface should be 0 °C min. and 60 °C max.



3.2 ELECTRICAL ABSOLUTE RATINGS

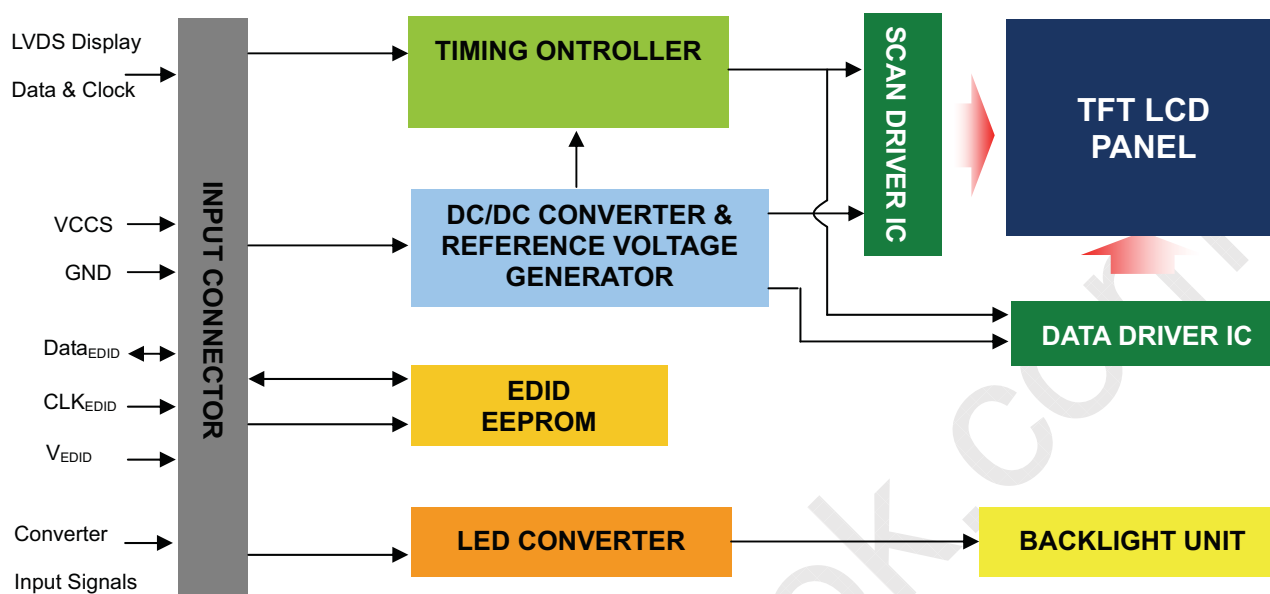
3.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCCS	-0.3	+4.0	V	(1)
Logic Input Voltage	V _{IN}	-0.3	VCCS+0.3	V	
Converter Input Voltage	LED_VCCS	-0.3	24	V	(1)
Converter Control Signal Voltage	LED_PWM,	-0.3	5	V	(1)
Converter Control Signal Voltage	LED_EN	-0.3	5	V	(1)

Note (1) Stresses beyond those listed in above “ELECTRICAL ABSOLUTE RATINGS” may cause permanent damage to the device. Normal operation should be restricted to the conditions described in “ELECTRICAL CHARACTERISTICS”.

4. ELECTRICAL SPECIFICATIONS

4.1 FUNCTION BLOCK DIAGRAM



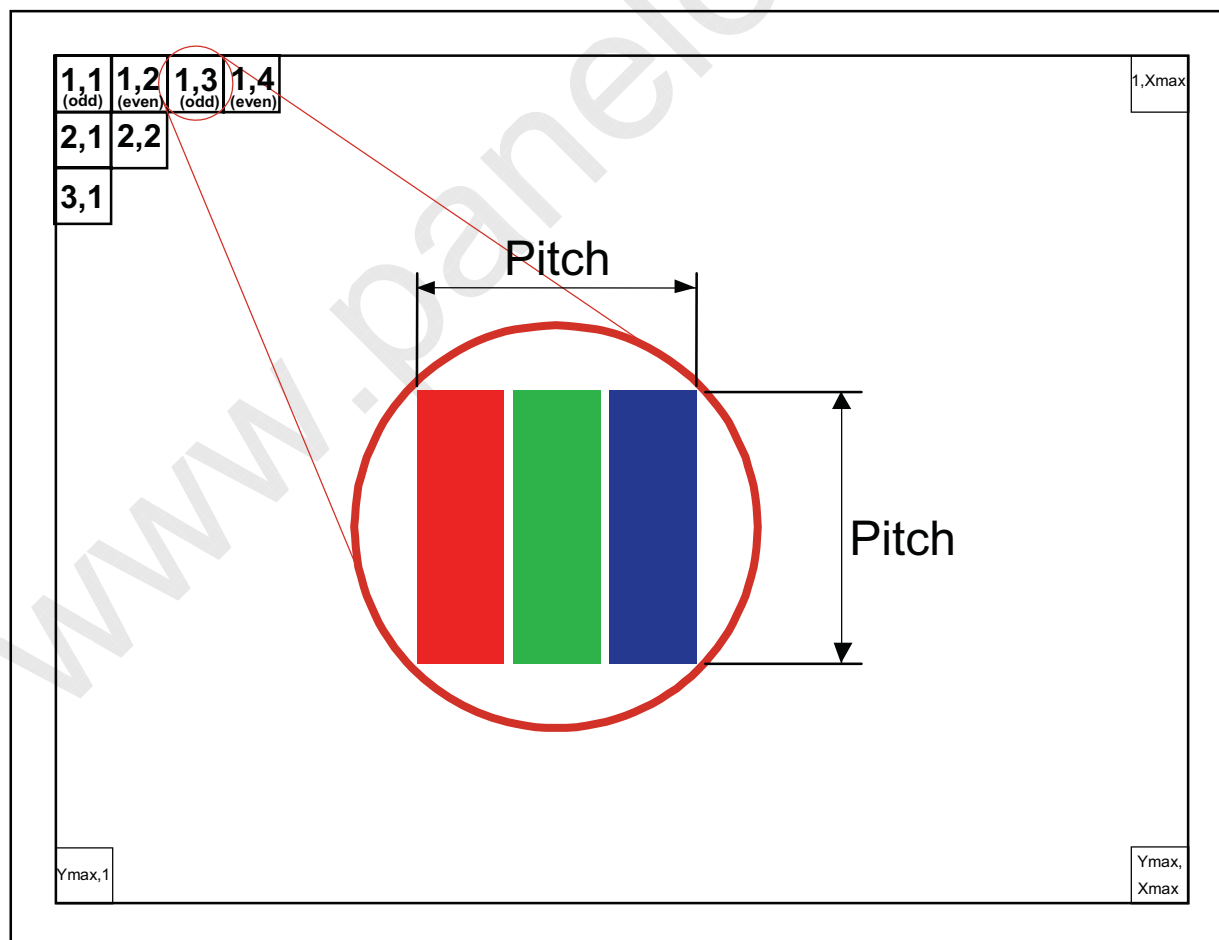
4.2. INTERFACE CONNECTIONS

PIN ASSIGNMENT

Pin	Symbol	Description	Remark
1	NC	No Connection (Reserve)	
2	VCCS	Power Supply (3.3V typ.)	
3	VCCS	Power Supply (3.3V typ.)	
4	VEDID	DDC 3.3V power	
5	NC	No Connection (Reserved for CMI test)	
6	CLKEDID	DDC clock	
7	DATAEDID	DDC data	
8	Rxin0-	LVDS differential data input	R0-R5, G0
9	Rxin0+	LVDS differential data input	
10	VSS	Ground	
11	Rxin1-	LVDS differential data input	G1~G5, B0, B1
12	Rxin1+	LVDS differential data input	
13	VSS	Ground	
14	Rxin2-	LVDS Differential Data Input	B2-B5,HS,VS, DE
15	Rxin2+	LVDS Differential Data Input	
16	VSS	Ground	
17	RxCLK-	LVDS differential clock input	LVDS CLK
18	RxCLK+	LVDS differential clock input	
19	VSS	Ground	
20	NC	No Connection (Reserve)	
21	NC	No Connection (Reserve)	
22	VSS	Ground	
23	NC	No Connection (Reserve)	

24	NC	No Connection (Reserve)	
25	VSS	Ground	
26	NC	No Connection (Reserve)	
27	NC	No Connection (Reserve)	
28	VSS	Ground	
29	NC	No Connection (Reserve)	
30	NC	No Connection (Reserve)	
31	LED_GND	LED Ground	
32	LED_GND	LED Ground	
33	LED_GND	LED Ground	
34	NC	No Connection (Reserve)	
35	LED_PWM	PWM Control Signal of LED Converter	
36	LED_EN	Enable Control Signal of LED Converter	
37	NC	No Connection (Reserve)	
38	LED_VCCS	LED Power Supply	
39	LED_VCCS	LED Power Supply	
40	LED_VCCS	LED Power Supply	

Note (1) The first pixel is odd as shown in the following figure.



4.3 ELECTRICAL CHARACTERISTICS

4.3.1 LCD ELETRONICS SPECIFICATION

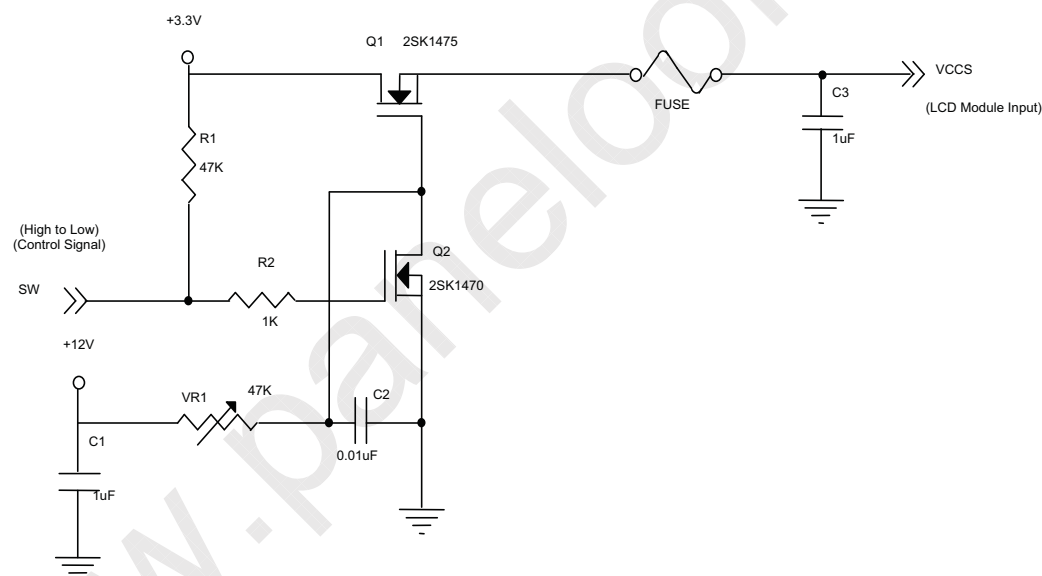
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		VCCS	3.0	3.3	3.6	V	(1)-
Ripple Voltage		V _{RP}	-	50	-	mV	(1)-
Inrush Current		I _{RUSH}	-	-	1.5	A	(1),(2)
Power Supply Current	Mosaic	I _{CC}	-	260	270	mA	(3)a
	Black		-	320	350	mA	(3)b
	Win XP		-	265	290	mA	
	1H2V		-	310	340	mA	

Note (1) The ambient temperature is $T_a = 25 \pm 2^\circ\text{C}$.

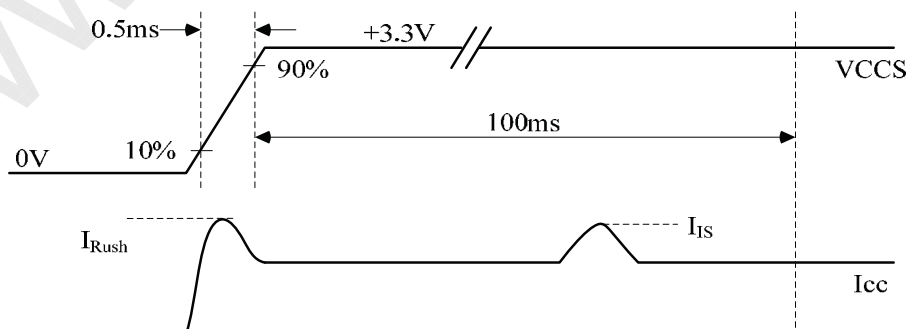
Note (2) I_{RUSH}: the maximum current when VCCS is rising

I_{IS}: the maximum current of the first 100ms after power-on

Measurement Conditions: Shown as the following figure. Test pattern: black.

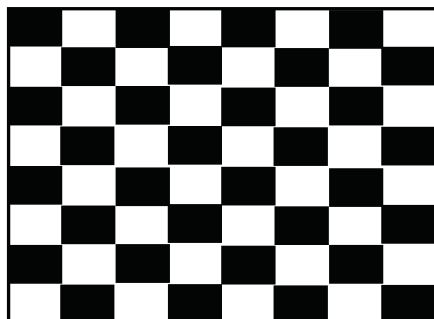


VCCS rising time is 0.5ms



Note (3) The specified power supply current is under the conditions at $V_{CCS} = 3.3\text{ V}$, $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$, DC Current and $f_v = 60\text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. Mosaic Pattern



Active Area

b. Black Pattern



Active Area

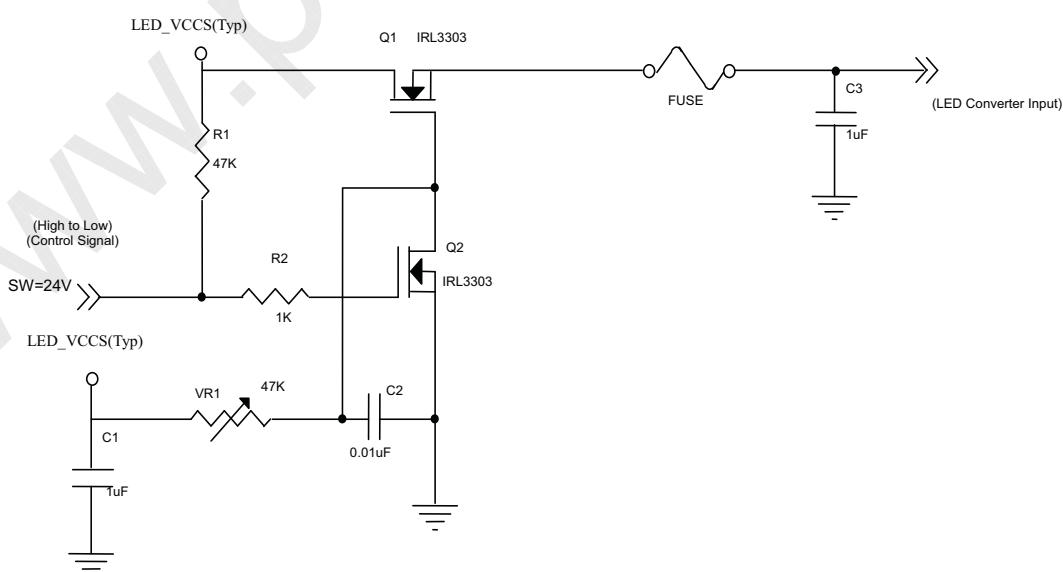
4.3.2 LED CONVERTER SPECIFICATION

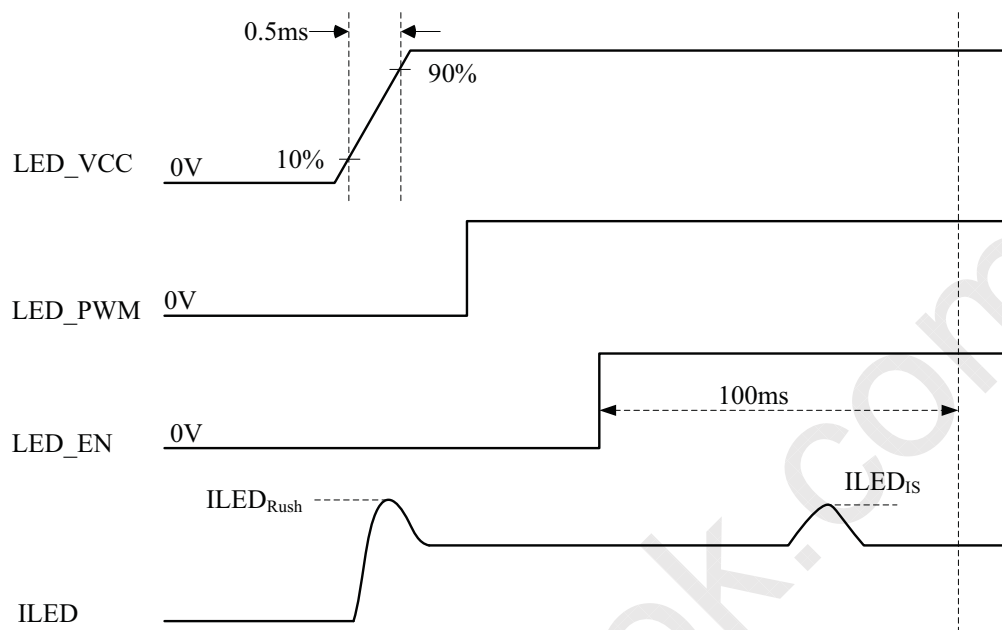
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Converter Input power supply voltage		LED_Vccs	6.0	12.0	21.0	V	
Converter Inrush Current		I _{LED_RUSH}	-	-	1.5	A	(1)
EN Control Level	Backlight On		2.0	-	5	V	
	Backlight Off		0	-	0.5	V	
PWM Control Level	PWM High Level		2.3	-	5	V	
	PWM Low Level		0	-	0.5	V	
PWM Control Duty Ratio			10	-	100	%	
			1	-	100	%	(2)
PWM Control Permissive Ripple Voltage		V _{PWM_pp}	-	-	100	mV	
PWM Control Frequency		f _{PWM}	100	-	2K	Hz	(3)
LED Power Current	LED_VCCS =Typ.	I _{LED}	288	339	398	mA	(4)

Note (1) I_{LED_RUSH}: the maximum current when LED_VCCS is rising,

I_{LED_IS}: the maximum current of the first 100ms after power-on,

Measurement Conditions: Shown as the following figure. LED_VCCS = Typ, Ta = 25 ± 2 °C, f_{PWM} = 200 Hz, Duty=100%.



VLED rising time is 0.5ms

Note (2) If the PWM control duty ratio is less than 10%, there is some possibility that acoustic noise or backlight flash can be found. And it is also difficult to control the brightness linearity.

Note (3) If PWM control frequency is applied in the range less than 1KHz, the “waterfall” phenomenon on the screen may be found. To avoid the issue, it’s a suggestion that PWM control frequency should follow the criterion as below.

PWM control frequency f_{PWM} should be in the range

$$(N + 0.33) * f \leq f_{PWM} \leq (N + 0.66) * f$$

N : Integer ($N \geq 3$)

f : Frame rate

Note (4) The specified LED power supply current is under the conditions at “LED_VCCS = Typ.”, $T_a = 25 \pm 2^\circ\text{C}$, $f_{PWM} = 200\text{ Hz}$, Duty=100%.

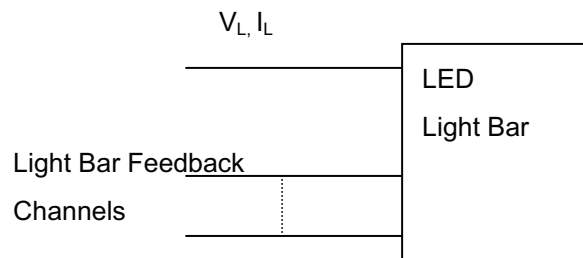
4.3.3 BACKLIGHT UNIT

$T_a = 25 \pm 2^\circ\text{C}$

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Light Bar Power Supply Voltage	V _L	22.4	25.6	27.2	V	(1)(2)(Duty100%)

LED Light Bar Power Supply Current	I _L	114	120	126	mA	
Power Consumption	P _L	2.554	3.072	3.472	W	(3)
LED Life Time	L _{BL}	15000	-	-	Hrs	(4)

Note (1) LED current is measured by utilizing a high frequency current meter as shown below :



Note (2) For better LED light bar driving quality, it is recommended to utilize the adaptive boost converter with current balancing function to drive LED light-bar.

Note (3) $P_L = I_L \times V_L$ (Without LED converter transfer efficiency)

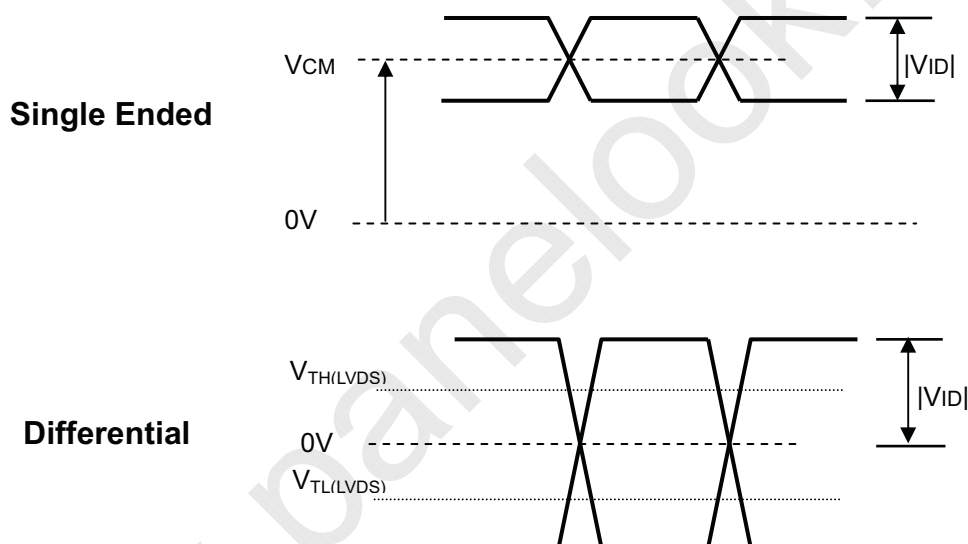
Note (4) The lifetime of LED is defined as the time when it continues to operate under the conditions at $T_a = 25 \pm 2^\circ\text{C}$ and $I_L = 24 \text{ mA}$ (Per EA) until the brightness becomes $\leq 50\%$ of its original value.

4.4 LVDS INPUT SIGNAL TIMING SPECIFICATIONS

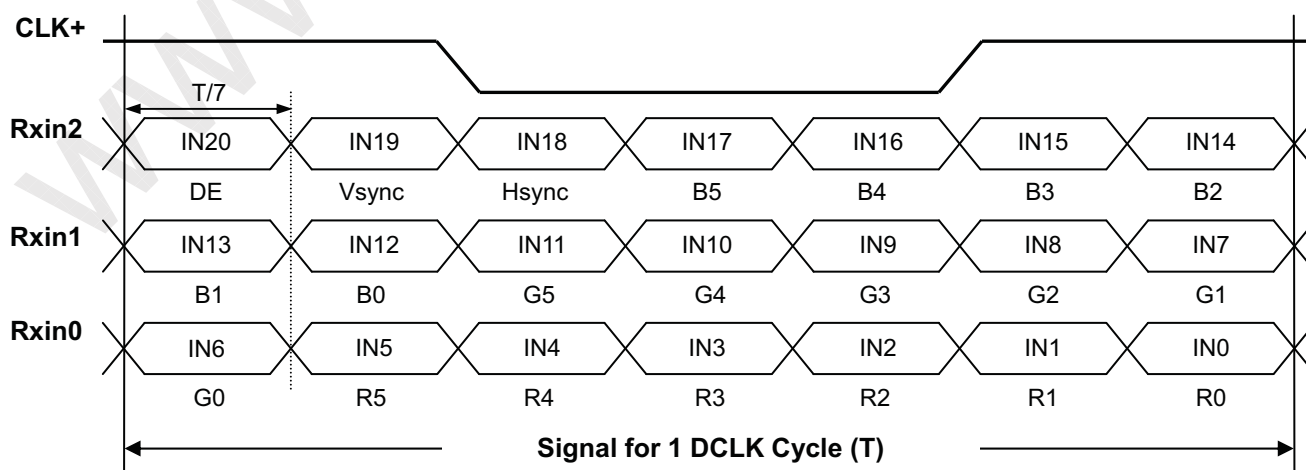
4.4.1 LVDS DC SPECIFICATIONS

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LVDS Differential Input High Threshold	$V_{TH(LVDS)}$	-	-	+100	mV	(1), $V_{CM}=1.2V$
LVDS Differential Input Low Threshold	$V_{TL(LVDS)}$	-100	-	-	mV	(1), $V_{CM}=1.2V$
LVDS Common Mode Voltage	V_{CM}	1.125	-	1.375	V	(1)
LVDS Differential Input Voltage	$ V_{ID} $	100	-	600	mV	(1)
LVDS Terminating Resistor	R_T	-	100	-	Ohm	-

Note (1) The parameters of LVDS signals are defined as the following figures.



4.4.2 LVDS DATA FORMAT



4.4.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
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	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	
Gray Scale Of Blue	Blue(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	

Note (1) 0: Low Level Voltage, 1: High Level Voltage

4.5 DISPLAY TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

Refresh rate 60Hz

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	62.4	69.3	72.8	MHz	-
DE	Vertical Total Time	TV	772	788	793	TH	-
	Vertical Active Display Period	TVD	768	768	768	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	20	TV-TVD	TH	-
	Horizontal Total Time	TH	1456	1466	1492	Tc	-
	Horizontal Active Display Period	THD	1366	1366	1366	Tc	-
	Horizontal Active Blanking Period	THB	TH-THD	100	TH-THD	Tc	-

Refresh rate 50Hz

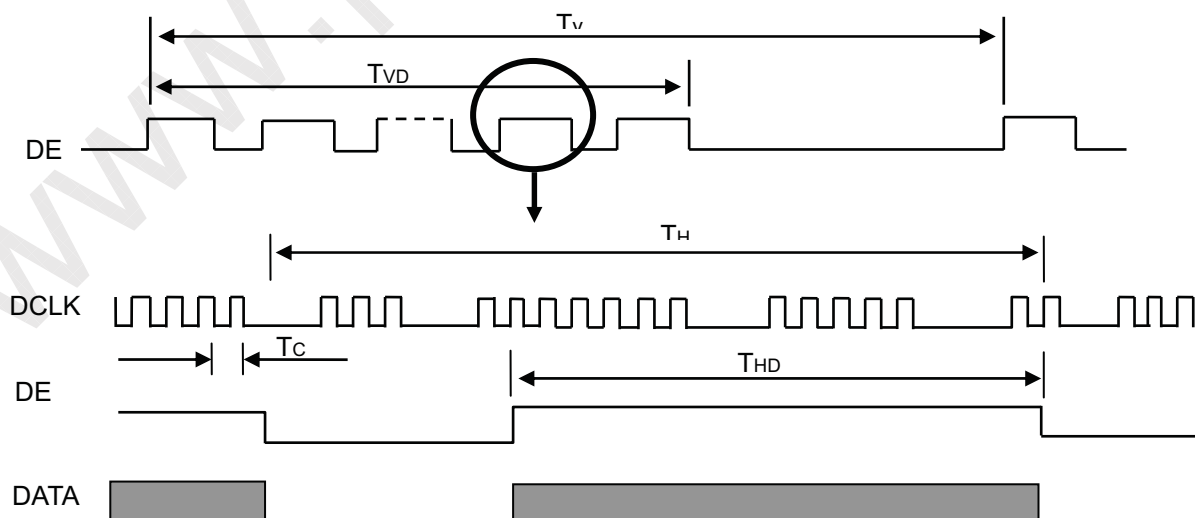
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	57.418	60.44	63.462	MHz	-
DE	Vertical Total Time	TV	772	788	793	TH	-
	Vertical Active Display Period	TVD	768	768	768	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	20	TV-TVD	TH	-
	Horizontal Total Time	TH	1523	1534	1561	Tc	-
	Horizontal Active Display Period	THD	1366	1366	1366	Tc	-
	Horizontal Active Blanking Period	THB	TH-THD	168	TH-THD	Tc	-

Refresh rate 40Hz

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	45.93	48.35	50.77	MHz	-
DE	Vertical Total Time	TV	772	788	793	TH	-
	Vertical Active Display Period	TVD	768	768	768	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	20	TV-TVD	TH	-
	Horizontal Total Time	TH	1523	1534	1561	Tc	-
	Horizontal Active Display Period	THD	1366	1366	1366	Tc	-
	Horizontal Active Blanking Period	THB	TH-THD	168	TH-THD	Tc	-

Note (1) Because this module is operated by DE only mode, Hsync and Vsync are ignored.

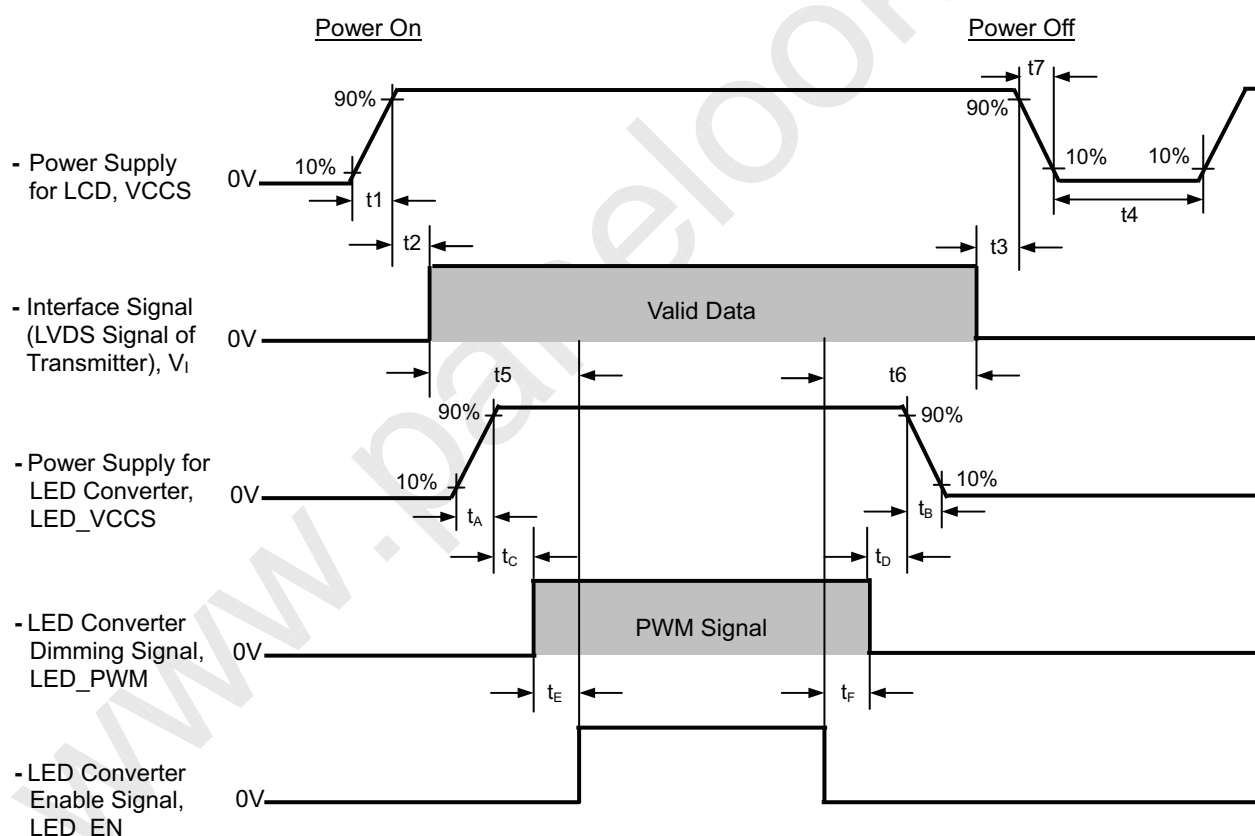
INPUT SIGNAL TIMING DIAGRAM



4.6 POWER ON/OFF SEQUENCE

The power sequence specifications are shown as the following table and diagram.

Symbol	Value			Unit	Note
	Min.	Typ.	Max.		
t1	0.5	-	10	ms	
t2	0	-	50	ms	
t3	0	-	-	ms	
t4	150	-	-	ms	
t5	200	-	-	ms	
t6	0	-	-	ms	
t7	0	-	10	ms	
t _A	0.5	-	10	ms	
t _B	0	-	-	ms	
t _C	0	-	-	ms	
t _D	0	-	-	ms	
t _E	0	-	-	ms	
t _F	0	-	-	ms	



Note (1) Please don't plug or unplug the interface cable when system is turned on.

Note (2) Please avoid floating state of the interface signal during signal invalid period.

Note (3) It is recommended that the backlight power must be turned on after the power supply for LCD and the interface signal is valid.

5. OPTICAL CHARACTERISTICS

5.1 TEST CONDITIONS

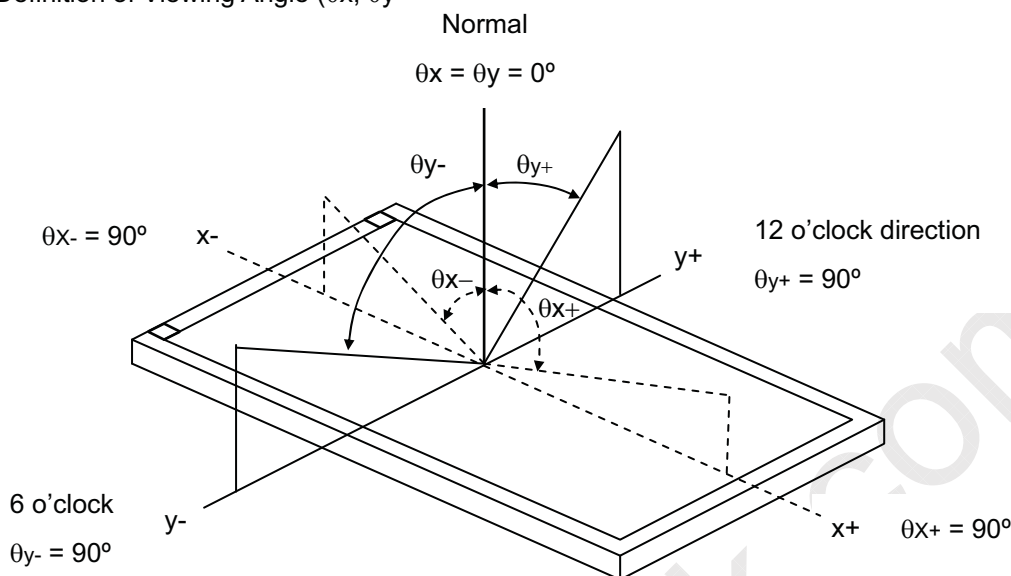
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V _{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Light Bar Input Current	I _L	120	mA

The measurement methods of optical characteristics are shown in Section 5.2. The following items should be measured under the test conditions described in Section 5.1 and stable environment shown in Note (5).

5.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta_x=0^\circ, \theta_Y=0^\circ$ Viewing Normal Angle	500	650	-	-	(2),(5),(8)
Response Time		T _R		-	3	8	ms	(3),(8)
		T _F		-	8	13	ms	
Luminance of White (5P)		L _{AVE}		185	220	-	cd/m ²	(4),(5),(8)
White Variation (5P)		δW		80	--		%	(5),(6),(8)
White Variation (13P)		δW		65	--		%	(5),(6),(8)
Color gamut		C.G		55	60		%	(5),(7),(8)
Color Chromaticity	Red	R _x		Typ.- 0.03	0.617	Typ.+ 0.03	-	(1), (5) (8)
		R _y			0.340		-	
	Green	G _x			0.320		-	
		G _y			0.598		-	
	Blue	B _x			0.160		-	
		B _y			0.084		-	
	White	W _x			0.313		-	
		W _y			0.329		-	
Viewing Angle	Horizontal	θ _x +	CR≥10	40	45	-	Deg.	(1),(5),(8)
		θ _x -		40	45	-		
	Vertical	θ _Y +		15	20	-		
		θ _Y -		40	45	-		

Note (1) Definition of Viewing Angle (θ_x , θ_y):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

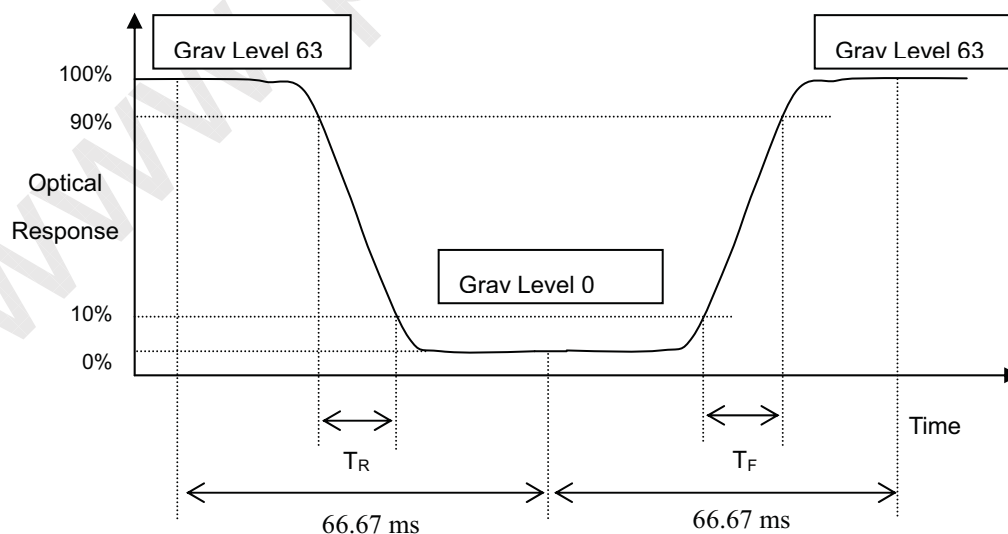
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

$$CR = CR(1)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time (T_R , T_F):



Note (4) Definition of Average Luminance of White (L_{AVE}):

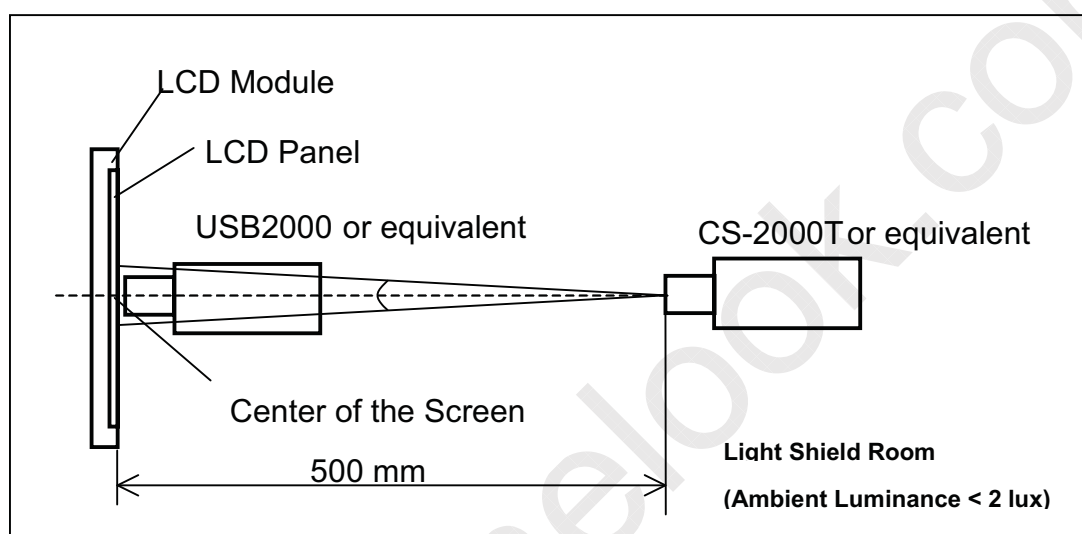
Measure the luminance of gray level 63 at 5 points

$$L_{AVE} = [L(1) + L(2) + L(3) + L(4) + L(5)] / 5$$

$L(x)$ is corresponding to the luminance of the point X at Figure in Note (6)

Note (5) Measurement Setup:

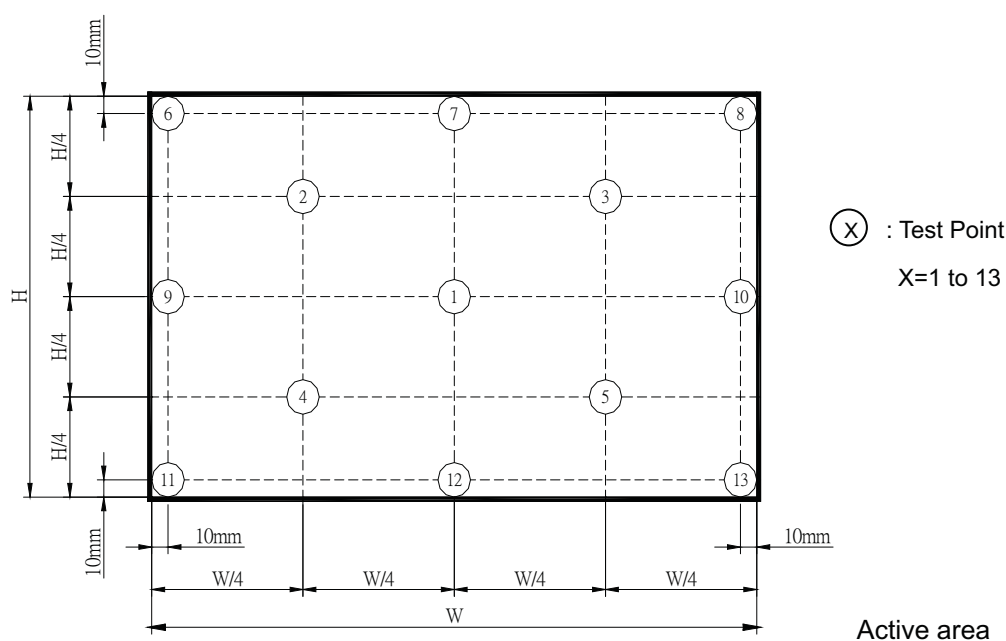
The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 63 at 5 points

$$\delta W_{5p} = \{ \text{Minimum} [L(1) + L(2) + L(3) + L(4) + L(5)] / \text{Maximum} [L(1) + L(2) + L(3) + L(4) + L(5)] \} * 100\%$$



Note (7) Definition of color gamut (C.G%):

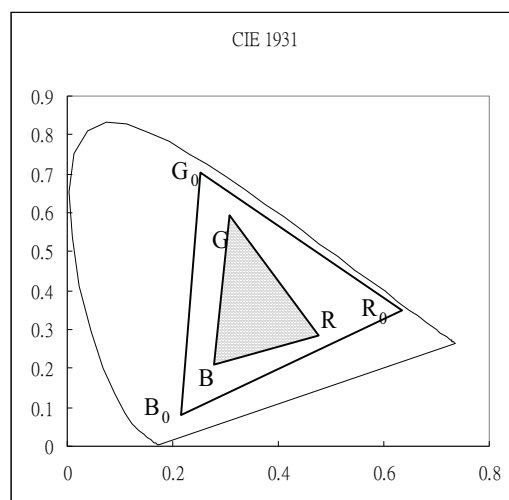
$$C.G\% = \frac{R G B}{R_0 G_0 B_0} \cdot 100\%$$

R_0, G_0, B_0 : color coordinates of red, green, and blue defined by NTSC, respectively.

R, G, B : color coordinates of module on 63 gray levels of red, green, and blue, respectively.

$R_0 G_0 B_0$: area of triangle defined by R_0, G_0, B_0

$R G B$: area of triangle defined by R, G, B



Note (8) The listed optical specifications refer to the initial value of manufacture, but the condition of the specifications after long-term operation will not be warranted.



6. RELIABILITY TEST ITEM

Test Item	Test Condition	Note
High Temperature Storage Test	60°C, 240 hours	(1) (2)
Low Temperature Storage Test	-20°C, 240 hours	
Thermal Shock Storage Test	-20°C, 0.5hour $\longleftrightarrow$ 60°C, 0.5hour; 100cycles, 1hour/cycle	
High Temperature Operation Test	50°C, 240 hours	
Low Temperature Operation Test	0°C, 240 hours	
High Temperature & High Humidity Operation Test	50°C, RH 80%, 240hours	(1) (3)
ESD Test (Operation)	150pF, 330 Ω , 1sec/cycle Condition 1 : Contact Discharge, $\pm$ 8KV Condition 2 : Air Discharge, $\pm$ 15KV	
Shock (Non-Operating)	220G, 2ms, half sine wave, 1 time for each direction of $\pm$ X, $\pm$ Y, $\pm$ Z	
Vibration (Non-Operating)	1.5G / 10-500 Hz, Sine wave, 30 min/cycle, 1cycle for each X, Y, Z	

Note (1) criteria : Normal display image with no obvious non-uniformity and no line defect.

Note (2) Evaluation should be tested after storage at room temperature for more than two hour

Note (3) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

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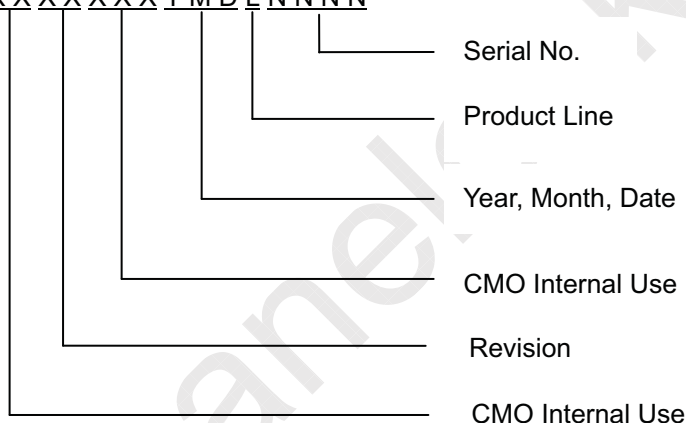
7. PACKING

7.1 MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



- (a) Model Name: N156B6 - L0B
 (b) Revision: Rev. XX, for example: C1, C2 ...etc.
 (c) Serial ID: X X X X X X Y M D L N N N N



Serial ID includes the information as below:

- (a) Manufactured Date: Year: 0~9, for 2010~2019
 Month: 1~9, A~C, for Jan. ~ Dec.
 Day: 1~9, A~Y, for 1st to 31st, exclude I, O and U
- (b) Revision Code: cover all the change
- (c) Serial No.: Manufacturing sequence of product
- (d) Product Line: 1 -> Line1, 2 -> Line 2, ...etc.

Serial ID includes the information as below:

- (a) Manufactured Date: Year: 1~9, for 2001~2009
Month: 1~9, A~C, for Jan. ~ Dec.
Day: 1~9, A~Y, for 1st to 31st, exclude I, O and U
- (b) Revision Code: cover all the change
- (c) Serial No.: Manufacturing sequence of product
- (d) Product Line: 1 -> Line1, 2 -> Line 2, ...etc.

For barcode content

11S PPPPPP Z1Z HHH SSSSSS YMM

- (a) 11S: Fixed characters.
- (b) PPPPPP (P/N): Fixed characters.
- (c) Z1Z: Fixed characters.
- (d) HHH (Header Code): FWV
- (e) SSSSSS: Series number.
- (f) YMM: Y: The last character of year. MM: Month

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7.2 CARTON

Box Dimensions : 442(L)*392(W)*300(H)

Weight: Approx. 10.5kg(20 module .per. 1 box)

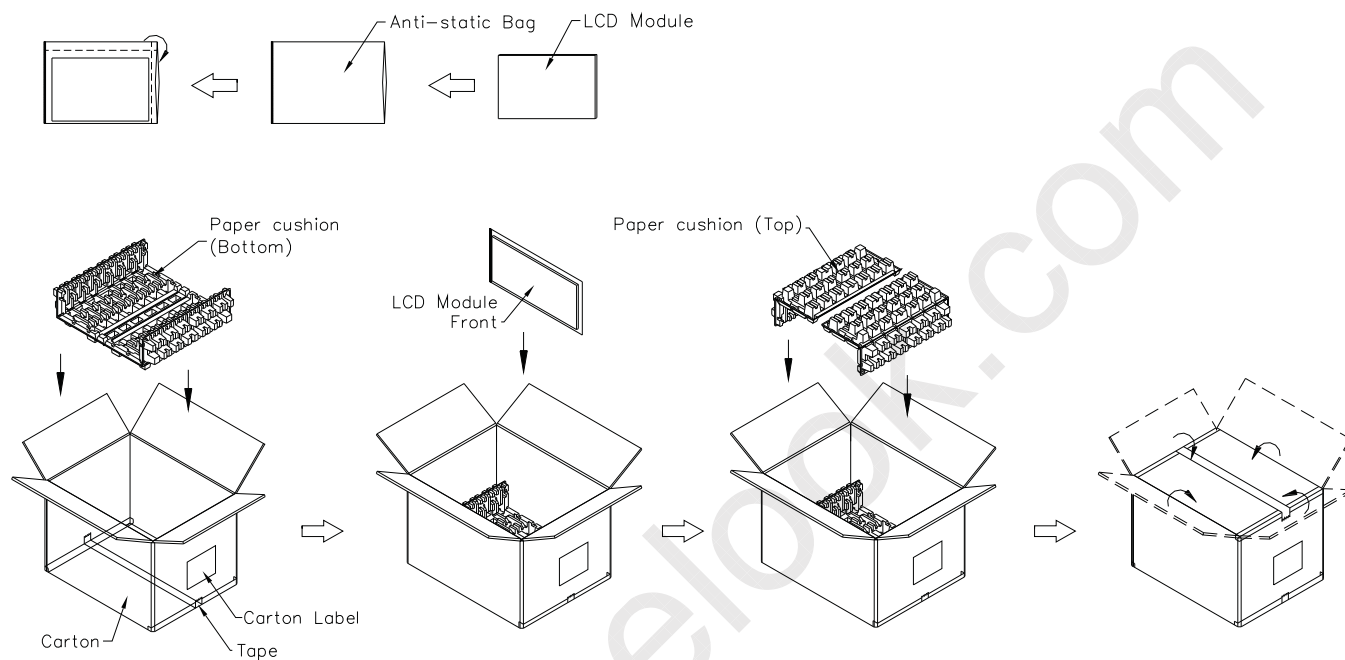
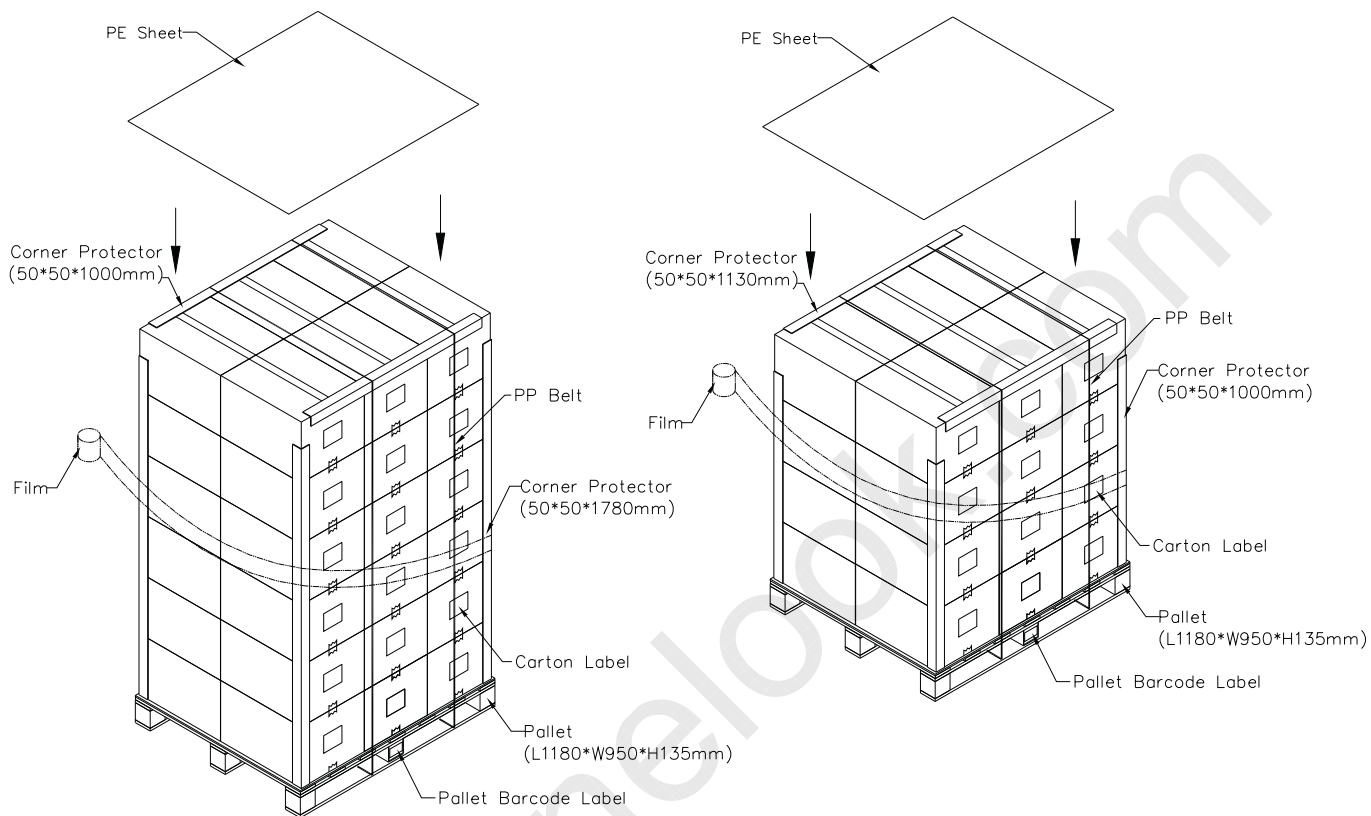


Figure. 7-2 Packing method

7.3 PALLET

Sea & Land Transportation

Air Transportation

**Figure. 7-3 Packing method**

8. PRECAUTIONS

8.1 HANDLING PRECAUTIONS

- (1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.
- (2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.
- (3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.
- (5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.
- (6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.
- (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.
- (8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.
- (9) Do not disassemble the module.
- (10) Do not pull or fold the LED wire.
- (11) Pins of I/F connector should not be touched directly with bare hands.

8.2 STORAGE PRECAUTIONS

- (1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
- (3) It may reduce the display quality if the ambient temperature is lower than 10 °C. For example, the response time will become slowly, and the starting voltage of LED will be higher than the room temperature.

8.3 OPERATION PRECAUTIONS

- (1) Do not pull the I/F connector in or out while the module is operating.
- (2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.
- (3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with converter. Do not disassemble the module or insert anything into the Backlight unit.

Appendix. EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats are to support displays as defined in the VESA Plug & Display and FPD/ standards.

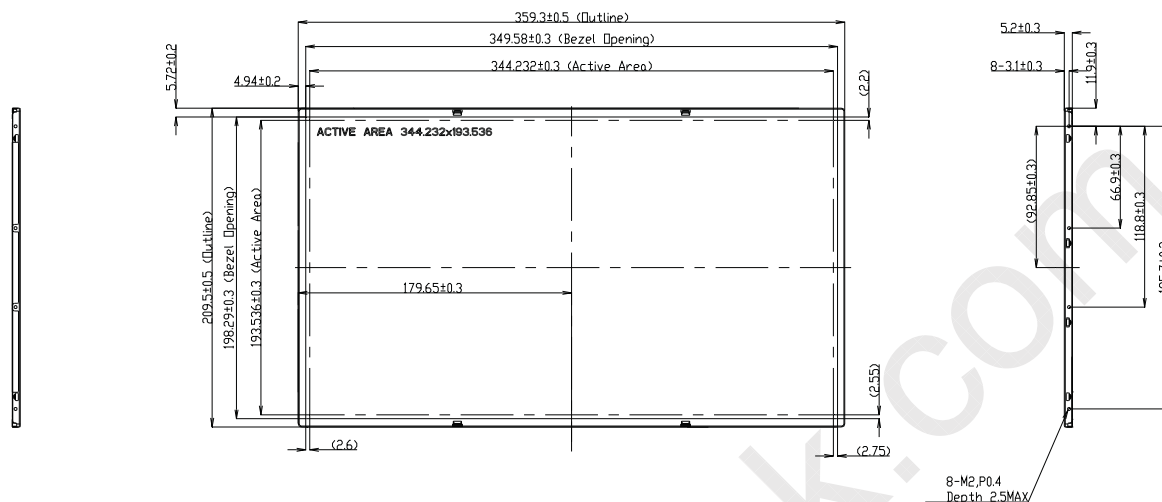
Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
0	0	Header	00	00000000
1	1	Header	FF	11111111
2	2	Header	FF	11111111
3	3	Header	FF	11111111
4	4	Header	FF	11111111
5	5	Header	FF	11111111
6	6	Header	FF	11111111
7	7	Header	00	00000000
8	8	ID system manufacturer name (LSB)	30	00110000
9	9	ID system manufacturer name (MSB)	AE	10101110
10	0A	ID system Product Code (LSB)	B0	10110000
11	0B	ID system Product Code (MSB)	40	01000000
12	0C	ID Serial Number (32-bit serial number)	00	00000000
13	0D	ID Serial Number (32-bit serial number)	00	00000000
14	0E	ID Serial Number (32-bit serial number)	00	00000000
15	0F	ID Serial Number (32-bit serial number)	00	00000000
16	10	Week of Manufacture	35	00110101
17	11	Year of Manufacture	13	00010011
18	12	EDID Structure version	01	00000001
19	13	EDID Revision	03	00000011
20	14	Video Input Definition	80	10000000
21	15	Active Area Horizontal Image Size (cm) - 35 cm	23	00100011
22	16	Active Area Vertical Image Size (cm) - 19cm	13	00010011
23	17	Display gamma (gamma x 100)-100, (Gamma 2.2)	78	01111000
24	18	Feature support	EA	11101010
25	19	Rx1, Rx0, Ry1, Ry0, Gx1, Gx0, Gy1, Gy0	7B	01111011
26	1A	Bx1, Bx0, By1, By0, Wx1, Wx0, Wy1, Wy0	95	10010101
27	1B	Rx=0.61	9C	10011100
28	1C	Ry=0.343	57	01010111
29	1D	Gx=0.342	57	01010111
30	1E	Gy=0.581	94	10010100
31	1F	Bx=0.162	29	00101001
32	20	By=0.083	15	00010101
33	21	Wx=0.313	50	01010000
34	22	Wy=0.329	54	01010100
35	23	Established Timing 1	00	00000000
36	24	Established Timing 2	00	00000000
37	25	Manufacturer's Timings	00	00000000
38	26	Standard Timing Identification #1	01	00000001
39	27	Standard Timing Identification #1	01	00000001
40	28	Standard Timing Identification #2	01	00000001
41	29	Standard Timing Identification #2	01	00000001



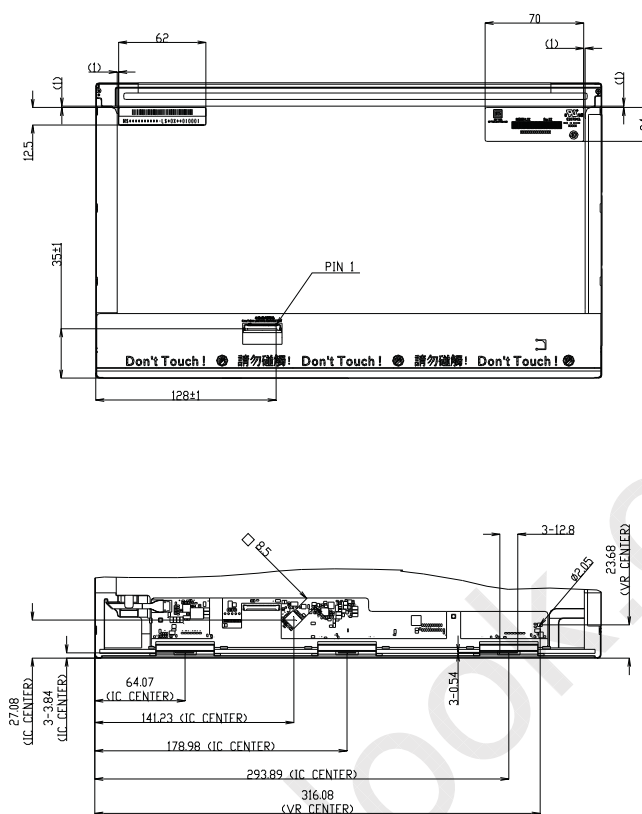
42	2A	Standard Timing Identification #3	01	00000001
43	2B	Standard Timing Identification #3	01	00000001
44	2C	Standard Timing Identification #4	01	00000001
45	2D	Standard Timing Identification #4	01	00000001
46	2E	Standard Timing Identification #5	01	00000001
47	2F	Standard Timing Identification #5	01	00000001
48	30	Standard Timing Identification #6	01	00000001
49	31	Standard Timing Identification #6	01	00000001
50	32	Standard Timing Identification #7	01	00000001
51	33	Standard Timing Identification #7	01	00000001
52	34	Standard Timing Identification #8	01	00000001
53	35	Standard Timing Identification #8	01	00000001
54	36	Detailed timing description # 1 Pixel clock ("69.3MHz", According to VESA CVT Rev1.1)	12	00010010
55	37	# 1 Pixel clock (hex LSB first)	1B	00011011
56	38	# 1 H active ("1366")	56	01010110
57	39	# 1 H blank ("100")	64	01100100
58	3A	# 1 H active : H blank ("1366 :100")	50	01010000
59	3B	# 1 V active ("768")	00	00000000
60	3C	# 1 V blank ("20")	14	00010100
61	3D	# 1 V active : V blank ("768 :20")	30	00110000
62	3E	# 1 H sync offset ("16")	10	00010000
63	3F	# 1 H sync pulse width ("34")	22	00100010
64	40	# 1 V sync offset : V sync pulse width ("2 : 6")	26	00100110
65	41	# 1 H sync offset : H sync pulse width : V sync offset : V sync width ("16: 34 : 2 : 6")	00	00000000
66	42	# 1 H image size ("344 mm")	58	01011000
67	43	# 1 V image size ("193 mm")	C1	11000001
68	44	# 1 H image size : V image size ("344 : 193")	10	00010000
69	45	# 1 H boarder ("0")	00	00000000
70	46	# 1 V boarder ("0")	00	00000000
71	47	# 1 Non-interlaced, Normal, no stereo, Separate sync, H/V pol Negatives	18	00011000
72	48	Detailed timing description # 2 Pixel clock ("60.44MHz", According to VESA CVT Rev1.1)	9C	10011100
73	49	#2 Pixel clock (hex LSB first)	17	00010111
74	4A	#2 H active ("1366")	56	01010110
75	4B	# 2 H blank ("168")	A8	10101000
76	4C	# 2 H active : H blank ("1366 : 168")	50	01010000
77	4D	# 2 V active ("768")	00	00000000
78	4E	# 2 V blank ("20")	14	00010100
79	4F	# 2 V active : V blank ("768 :20")	30	00110000
80	50	# 2 H sync offset ("51")	33	00110011
81	51	# 2 H sync pulse width ("34")	22	00100010
82	52	# 2 V sync offset : V sync pulse width ("3 : 5")	35	00110101
83	53	# 2 H sync offset : H sync pulse width : V sync offset : V sync width ("51: 34 : 3 : 5")	00	00000000
84	54	# 2H image size ("344 mm")	58	01011000
85	55	# 2V image size ("193 mm")	C1	11000001



86	56	# 2 H image size : V image size ("344 : 193")	10	00010000
87	57	# 2 H boarder ("0")	00	00000000
88	58	# 2 V boarder ("0")	00	00000000
89	59	# 2 Non-interlaced ; Normal display, no stereo ; Digital Separate ; V sync POL is negative ; H sync POL is positive	18	00011000
90	5A	Flag	00	00000000
91	5B	Flag	00	00000000
92	5C	Flag	00	00000000
93	5D	Data Type Tag	0F	00001111
94	5E	Flag	00	00000000
95	5F	Middle Refresh Rate #1 (Horizontal active pixels / 8) - 31	8C	10001100
96	60	Middle Refresh Rate #1 Image Aspect ratio (16 : 9)	09	00001001
97	61	Middle Refresh Rate #1 Refresh Rate = 50Hz	32	00110010
98	62	Low Refresh Rate #2 (Horizontal active pixels / 8) - 31	8C	10001100
99	63	Low Refresh Rate #2 Image Aspect ratio(16 : 9)	09	00001001
100	64	Low Refresh Rate #2 Refresh Rate=40Hz	28	00101000
101	65	Brightness(220 /10 nit)	16	00010110
102	66	Feature flag	09	00001001
103	67	Reserved	00	00000000
104	68	LCD Supplier manufacturer code	0D	00001101
105	69	LCD Supplier manufacturer code, (Hex, LSB first)	AF	10101111
106	6A	LCD Supplier Product code	50	01010000
107	6B	LCD Supplier Product code (Hex, LSB first)	14	00010100
108	6C	Flag	00	00000000
109	6D	Flag	00	00000000
110	6E	Flag	00	00000000
111	6F	Data Type Tag	FE	11111110
112	70	Flag	00	00000000
113	71	Model Name (N156B6-L0B, 1st character, "N")	4E	01001110
114	72	Model Name (N156B6-L0B, 2nd character, "1")	31	00110001
115	73	Model Name (N156B6-L0B, 3rd character, "5")	35	00110101
116	74	Model Name (N156B6-L0B, 4th character, "6")	36	00110110
117	75	Model Name (N156B6-L0B, 5th character, "B")	42	01000010
118	76	Model Name (N156B6-L0B, 6th character, "6")	36	00110110
119	77	Model Name (N156B6-L0B, 7th character, "-")	2D	00101101
120	78	Model Name (N156B6-L0B, 8th character, "L")	4C	01001100
121	79	Model Name (N156B6-L0B, 9th character, "0")	30	00110000
122	7A	Model Name (N156B6-L0B, 10th character, "B")	42	01000010
123	7B	Model Name(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	0A	00001010
124	7C	Model Name (If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
125	7D	Model Name (If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
126	7E	Extension flag	00	00000000
127	7F	Checksum	69	01101001

**Appendix. OUTLINE DRAWING****NOTES:**

- 1.Max screw length: 2.5mm.
- 2.Screw torque: 2.3~2.5 kgf-cm.
- 3.LCD module input connector: I-PEX 20455-040E-12 or Tyco 5-2069716-3.
- 4.Gap between bezel and panel: 0.5mm MAX.
- 5.In order to avoid abnormal display, pooling and white spot, no overlapping is suggested at cables, antennas, camera, WLAN, WAN or other foreign objects over CDF driver IC, TCON and VR locations.
- 6.Max module flatness: 0.5mm.
7. "C" MARKS THE REFERENCE DIMENSIONS.



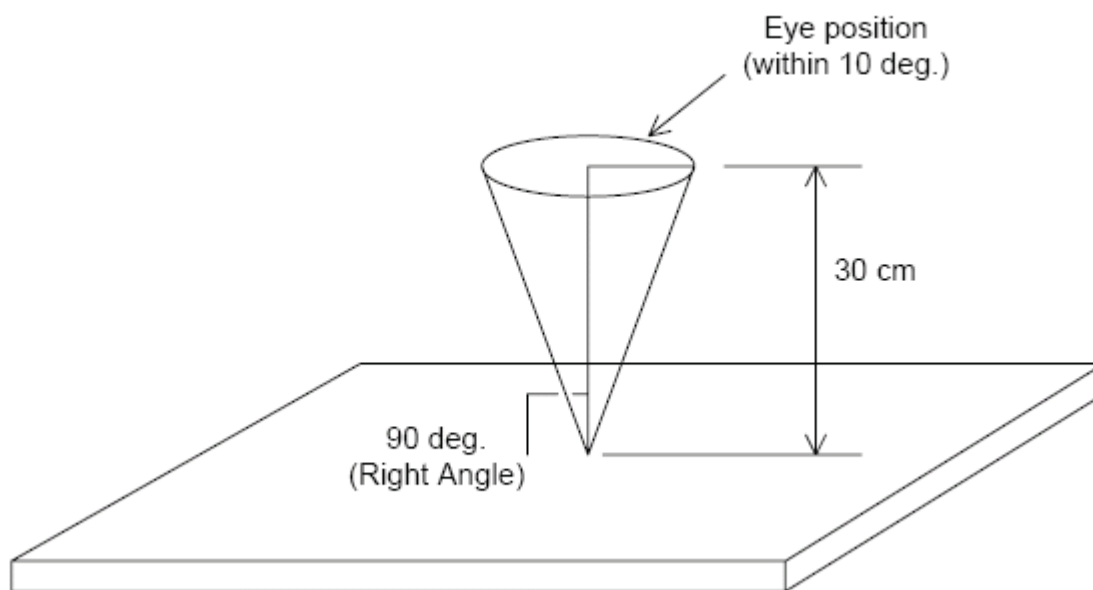
Appendix. LCD MODULE INSPECTION SPECIFICATION**A. Description**

These inspection standards shall be applied to LCD Module supplied by CHI MEI Optoelectronics Corporation.

B. The environmental condition of inspection

The environmental condition and visual inspection shall be conducted as below.

- (1) Ambient temperature : 15~25°C
- (2) Humidity: 25~75 %RH
- (3) External appearance inspection shall be conducted by using a single 20W fluorescent lamp or equivalent illumination.
- (4) Panel visual inspection on the operation condition for cosmetic shall be conducted at the distance 30cm between the LCD module and eyes of inspector.

**(5) Using method for ND Filter**

When using ND Filter for judging Mura, placing ND Filter near Mura defect and get close to the surface of LCD Panel (its distance shall be 1~2cm between the surface of Panel and ND Filter).

Don't touch the surface of polarizer to avoid scratching polarizer, and then move to the defect position to judge mura by view angel 90 degree (The viewing angle shall be 90 degree to the right top of Mura defect with panel)

C. Classification of defects

Defects are classified two types, major defect and minor defect according to the defect. And, the definition of defects is classified as below.

(1) Major defect

Any defect may result in functional failure, or reduce the usability of product for its purpose. For example, electrical failure, deformation and etc..

(2) Minor defect

A defect that is not to reduce the usability of product for its intended purpose and un-uniformity, dot defect and etc..

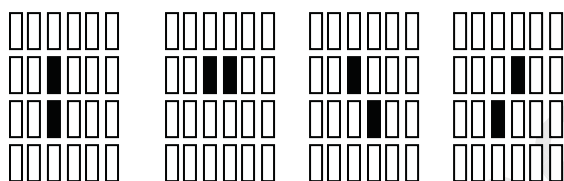
The criteria on major and/or minor judgement will be according with the classification of defects.

D. Inspection Criteria

(1) Definition of dot defect

Define spec for 2 dot adjacent and minimum distance

2-adjacent(Linked Pixels)



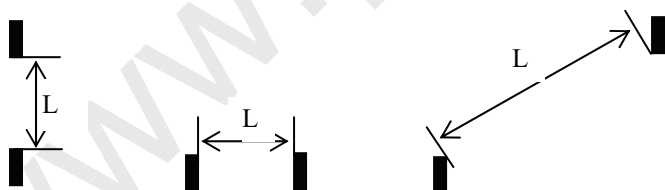
□ : sub-Pixel(R,G,B)

Minimum Distance;

Lit to Lit : $L \geq 15\text{mm}$

Unlit to Unlit : $L \geq 5\text{mm}$

Lit to Unlit : Not Applicable



L: Sub-Pixel to Sub-Pixel, Sub-Pixel to 2-adjacent or 2-adjacent to 2-adjacent



(2) Display Inspection

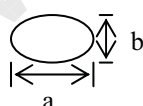
- a) Ambient Illumination: 250 Lux or more for light on inspection
- b) Viewing Angle: Within LCD Viewing Angle Specification
- c) Inspection Pattern (Bright dot): In black pattern
Inspection Pattern (Dark dot): In red, green , blue pattern

Items		XGA WXGA	SXGA+ WXGA+ WSXGA+	UXGA WUXGA	HD HD+ FHD
Bright dot	Random	$N \leq 2$	$N \leq 2(G=1)$	$N \leq 2(G=0)$	$N \leq 2(G=0)$
	2 dots adjacent	$N \leq 1(G=0)$	$N \leq 0$	$N \leq 0$	$N \leq 0$
	3 dots adjacent or more	$N \leq 0$	$N \leq 0$	$N \leq 0$	$N \leq 0$
Dark dot	Random	$N \leq 3$	$N \leq 5$	$N \leq 10$	$N \leq 3$
	2 dots adjacent	$N \leq 1$	$N \leq 1$	$N \leq 2$	$N \leq 1$
	3 dots adjacent or more	$N \leq 0$	$N \leq 0$	$N \leq 0$	$N \leq 0$
Distance	Lit to Lit	$L \geq 15\text{mm}$	$L \geq 15\text{mm}$	$L \geq 15\text{mm}$	$L \geq 15\text{mm}$
	Unlit to Unlit	$L \geq 5\text{mm}$	$L \geq 5\text{mm}$	$L \geq 5\text{mm}$	$L \geq 5\text{mm}$
	Lit to Unlit	Not allowable	Not allowable	Not allowable	Not allowable
Total bright and dark dot		$N \leq 5$	$N \leq 7$ (SXGA+ WXGA+) $N \leq 9$ (WSXGA+)	$N \leq 10$ (UXGA) $N \leq 12$ (WUXGA)	$N \leq 5$
Defective Dot (Lit/Unlit) : Noticeable defective dots in the office environment (250 lux) will be counted regardless of defective dot size					
Display failure (V-line/H-line/Cross line etc.)				Not allowable	
Mura	Mura defect can not show in 50% gray pattern with 8% ND-filter or judge by limit sample if necessary				

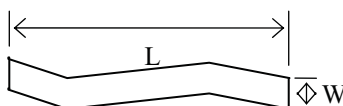
**(3) Appearance inspection**

- a) Ambient Illumination: 500 ~ 700 Lux
- b) Viewing Angle: Backlight-Off Condition: At Right Angle To Polarizer Surface
Backlight-On Condition: Within LCD Viewing Angle Specification
- c) Inspection Pattern: In White and 32-Gray(Half-Gray)Screens(Backlight-On)

Items	Size(mm)	Acceptable count
1. Scratch(Line Shape) : B/L –off condition	$W < 0.05$	Ignore
	$0.05 \leq W < 0.1; 0.3 \leq L \leq 3.0$	$N \leq 4$
	$0.10 \leq W$ or $3.0 < L$	$N = 0$
	Shall be no visible at B/L on.	
2. Dent : B/L –off condition	$D < 0.2$	Ignore
	$0.2 \leq D < 0.5$	$N \leq 5$
	$0.5 \leq D$	$N = 0$
	Spacing between defects shall be more than 30 mm. ($0.2 \leq D < 0.5$) Shall be no visible at B/L on.	
3. Bubble : B/L –off condition	$D < 0.2$	Ignore
	$0.2 \leq D < 0.5$	$N \leq 5$
	$0.5 \leq D$	$N = 0$
	Shall be no visible at B/L on.	
4. Foreign material (Line-shape: stain inclusion) :B/L-on condition	$W < 0.05$	Ignore
	$0.05 \leq W < 0.10; 0.3 < L \leq 2.0$	$N \leq 4$
	$0.10 < W$ or $2.0 < L$	$N = 0$
	Shall be no visible at B/L on.	
5. Foreign material (Dot-shape: stain inclusion) :B/L-on condition	$D < 0.2$	Ignore
	$0.2 \leq D < 0.5$	$N \leq 5$
	$0.5 \leq D$	$N = 0$
6. Peeling on Polizer edge :B/L-off condition	$D < 0.2$	Ignore
	$0.2 \leq D < 0.5$	$N \leq 5$
	$0.5 \leq D$	$N = 0$
	Bubble or glue shall not be visible within PC bezel opening area with specified inspection viewing angle.	
	Continuous peeling off on polarizer edge shall be discussed. Shall be no visible at B/L on.	



$$D = (a+b)/2$$



W: width, L : length

**E. External Appearance Inspection Criteria**

Item	Contents	
Screw	Parts mounting, incomplete assembly, deformation, oxidized, crooked or rusty is not permitted.	
CCFT cable	Cable not continuous 、Break-off 、Connector Burn-off /Break-off	
Metal frame (Bezel)	Scratch	*Noticeable scratch and exfoliation coating are not permitted. *The oxidized metal is not permitted.
	Incomplete assembly is not permitted.	
Backlight	Scratch	The scratch which may causes a problem in practical use is not permitted.
	Break-off	Breaking off is not permitted.
	Crack	The crack is not permitted.
Stain on Polarizer	The stain which can't be wiped off is not permitted.	
Tape/Label	Incorrect position, missed label is not permitted.	
Connector	Oxidized/rusty connector is not permitted.	
Outline size	Spec. out is not permitted.	



F. Classification of defects

Inspection Item	Criteria and Description	Defect type
Vertical line	Signal input, vertical line off or irregular V-line appears	major
Horizontal line	Signal input, horizontal line off or irregular H-line appears	major
Cross line	Pattern signal input, a correct display is not obtained	major
No display	Signal input, display is dead	major
Irregular display	Pattern signal input, a correct display is not obtained	major
Dots defect	Exceed specified standards	minor
Scratch and Dent on polarizer	Exceed specified standards	minor
Foreign material	Exceed specified standards	minor
Mura	Mura defect can not show in 50% gray pattern with 8% ND-filter or judge by limit sample if necessary	minor
External Appearance	Rust, deformation, irregular plating, coating missing etc. A appearance defect that do not affect function or performance	minor
Bezel claw	Bezel claw missing or not bent	major
Polarizer bubble	Exceed specified standards	minor
Flicker	No noticeable flicker by naked eyes at any gray scale level	major
LCD Pooling	In 50% gray pattern, hold LCD panel TOP edge (PCB side) by both hands and swing slightly back and forth 2 times per second for 3 cycles by 15 degrees (Range 30 degrees)	minor